

## CLAIMS

What is claimed:

1. A gaseous-fuel fumigation system for interconnection to a diesel engine,  
5 comprising:
  - a first valve disposed in a flow path between a gaseous-fuel supply and an air intake stream of a diesel engine, the first valve being operative to regulate a flow volume of a gaseous-fuel through the flow path based on a load level associated with the engine;
  - a second valve, disposed in series with the first valve in the flow path, the second  
10 valve being operative to regulate the flow volume of the gaseous-fuel through the flow path based at least in part on an oxygen content of exhaust gases in an exhaust stream of the engine.
2. The system of Claim 1, wherein the first valve establishes a first flow  
15 volume and the second valve is operative to establish a second flow volume between zero and one hundred percent of the first flow volume, wherein the second flow volume reaches the air intake stream.
3. The system of Claim 1, wherein the first valve regulates the flow volume  
20 of gaseous-fuel in relation to a boost pressure associated with a turbocharger attached to the engine.

4. The system of Claim 3, wherein the first valve is operated by the boost pressure associated with the turbocharger.

5. The system of Claim 1, further comprising:  
an oxygen sensor, the sensor being operative to generate a sensor signal indicative of an oxygen content within the exhaust stream of the engine; and  
an electronic control operative to receive the sensor signal and, based on the sensor signal, control the operation of the second valve.

10 6. The system of Claim 5, wherein the electronic control maintains at least a predetermined minimum oxygen content in the exhaust stream using the second valve to regulate the flow volume of gaseous-fuel that reaches the air intake stream.

15 7. The system of Claim 6, wherein the predetermined minimum oxygen content is user selectable.

8. The system of Claim 6, wherein the predetermined minimum oxygen content is based at least in part on one of:  
a gaseous-fuel parameter; and  
20 an operating parameter of the engine.

9. The system of Claim 6, wherein the flow volume of the gaseous-fuel through the second valve is increased when the oxygen content is above the predetermined minimum oxygen content.

5 10. The system of Claim 6, wherein the flow volume of gaseous-fuel through the second valve is decreased when the oxygen content is below the predetermined minimum oxygen content.

10 11. The system of Claim 1, wherein at least one of said first and second valves further comprises:

an adjuster for establishing a predetermined maximum flow volume through said flow path.

12. The system of Claim 1, wherein said gas supply comprises at least one of:  
15 natural gas;  
methane gas;  
propane;  
hydrogen;  
vaporized ethanol; and  
20 vaporized methanol.

13. The systems of Claim 1, wherein said gas supply comprises a gas well.

14. A gaseous-fuel fumigation system for interconnection to a diesel engine, comprising:

5 a first valve disposed in a flow path between a gaseous-fuel supply and an air intake stream of a diesel engine, the valve being operative to regulate a flow volume of a gaseous-fuel through the flow path;

an oxygen sensor operative to generate a signal indicative of an oxygen content of an exhaust stream of the engine;

10 a controller operative to receive the signal from the oxygen sensor and adjust the first valve to maintain a predetermined minimum oxygen content in the exhaust stream.

15. The system of Claim 14, wherein the controller further comprises:

an oxygen content adjuster operative to selectively set the predetermined minimum oxygen content.

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16. The system of Claim 14, wherein the oxygen sensor comprises:

a wide band oxygen sensor.

17. The system of Claim 14, wherein the flow volume of gaseous-fuel through 20 the first valve is increased when the oxygen content is above the predetermined minimum oxygen content.

18. The system of Claim 14, wherein the flow volume of gaseous-fuel through the first valve is decreased when the oxygen content is below the predetermined minimum oxygen content.

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19. The system of Claim 14, further comprising:  
an engine-load valve disposed in series with the first valve in said flow path, said engine-load valve being operative to regulate the flow volume of the gaseous-fuel through the flow path based on a load level associated with the engine.

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20. The system of Claim 19, wherein the engine-load valve establishes a first flow volume and the first valve is operative to establish a second flow volume between zero and one hundred percent of the first flow volume, wherein the second flow volume reaches the air intake stream.

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21. The system of Claim 19, wherein the engine-load valve regulates the flow volume of gaseous-fuel in relation to a boost pressure associated with a turbocharger attached to the engine.

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22. The system of Claim 14, wherein said first valve further comprises:  
an adjuster for establishing a predetermined maximum flow volume through said flow path.

23. A gaseous-fuel fumigation system for interconnection to a diesel engine, comprising:

5 a first valve disposed in a flow path between a gaseous-fuel supply and an air intake stream of a diesel engine, the first valve being operative to move from a closed position to an at least partially open position in response to a predetermined minimum boost pressure from a turbocharger associated with the engine; and

10 a by-pass port passing through the first valve for maintaining a predetermined minimum flow volume of gaseous-fuel across the first valve while first valve is in a closed position.

24. The system of Claim 23, wherein said by-pass port further comprises:  
an adjuster operative to adjust the predetermined minimum flow volume.

15 25. The system of Claim 23, wherein said first valve further comprises:  
an adjuster operative to adjust the predetermined minimum boost pressure necessary to at least partially open the first valve.

26. The system of Claim 23, further comprising:  
20 a second valve, disposed in series with the first valve in the flow path, the second valve being operative to further regulate the flow volume of the gaseous-fuel through the flow path based at least in part on an oxygen content of exhaust gases in an exhaust stream of the engine.

27. A method for operating a gaseous-fuel fumigation system interconnected to a diesel engine, comprising:

establishing a first flow volume of a gaseous-fuel for a diesel engine based on a load level of the diesel engine;

5 identifying an oxygen content of an exhaust stream of the engine;

based on the oxygen content, regulating the first flow volume to establish a second flow volume, wherein the second flow volume is between zero and one hundred percent of the first flow volume; and

injecting the second flow volume into an air intake stream of the engine.

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28. The method of Claim 27, wherein said regulating step comprises one of increasing and decreasing said second flow volume to maintain a predetermined oxygen content in the exhaust stream.

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29. The method of Claim 27, further comprising:

identifying a desired oxygen content for the engine based on at least one engine specific parameter; and setting a controller to the desired oxygen content wherein the controller is operative to regulate the first flow volume to establish the second flow volume.

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30. The method of Claim 27, wherein the establishing a first flow volume step comprises operating a first valve in a flow path between a gaseous fuel supply and the air intake stream.

31. The method of Claim 27, wherein the establishing a second flow volume step comprises operating a second valve in the flow path between the gaseous fuel supply and the air intake.

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